ACCELERATED LANDFILL BIOSTABILIZATION: A CASE HISTORY

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ABSTRACT

Large-scale aerobic biostabilization of landfilled municipal refuse has been successfully accomplished in Albany, New York. Significant volume reductions of previously buried and newly placed refuse have been recorded and technology has been developed to effectively mitigate odor and vector impacts. All activities occurred within the landfill cell without need for ancillary structures or additional real estate.

PROJECT BACKGROUND

Landfill Description

The Greater Albany Landfill is a 61-acre (24.7 hectare) municipal site first opened in 1969. Refuse is mounted to a height of nearly 100 ft (30.5 m) above the original sandy terrain: more than two million short tons (1,814,360 metric tons) of municipal solid waste are now in place.

Refuse Stabilization Technology

Forced aerobic decay is the principal technique employed in this project. A great deal is known about the general subject of aerobic decomposition of organic material, or "composting" as it is sometimes termed. What is not generally known is how to accomplish refuse biostabilization at full scale on an existing landfill within the constraints of appropriate odor and vector control and at a feasible cost. Development and practice of such technology was the goal of this project.

PROJECT PHASE I – STABILIZATION OF PREVIOUSLY BURIED REFUSE

General Procedure

The initial methods employed to size reduce, moisture adjust and pH buffer the buried refuse were rather crude, since these procedures had not been previously practiced. In September 1989, the clay cap was scraped off with a dragline and then large bulldozers excavated and disintegrated the buried refuse by pushing, turning, and twisting the material beneath their steel tracks. Water and lime were added as required for moisture and pH adjustment.

The processed material was stockpiled and then moved repeatedly to re-aerate and further physically disintegrate the substrate. Temperatures in the stock piles were observed to rise above 120°F (48.9°C), and copious amounts of water vapor were released during moving operations. Within sixty (60) days the physical appearance of the material became more benign, appearing from a distance like soil mixed with plastic shreds. A great percentage of the cellulose, however, was not actually degraded, but merely converted to a brown, relatively uniform appearance.

Exact topographic surveys were performed monthly and the volume change in the prescribed work area recorded. In April 1990, the Phase I activity was completed and the stabilized material was spread evenly over the floor of the work area which visually resembled a crater.

SUMMARY OF RESULTS

Volume Reduction

A total of approximately 52,000 cubic yards, CY, (39,759 cubic meters, CM) of raw refuse was han-

dled. Topographic records indicated a volume loss in the work area of nearly 33,000 CY (25,232 CM), of which about 16,000 CY (12,234 CM) were removed as substitute daily cover material. This leaves a net reduction in volume of about 17,000 CY (12,998 CM), or about 33% of beginning volume. The treated material was also more uniform in physical character and was easily compacted during final placement.

ENVIRONMENTAL IMPACTS

The principal environmental problem with the Phase I activity was the release of foul odors which created complaints from nearby residents during certain atmospheric conditions. Attempts to correct this problem by surface application of lime were only partially successful. It was determined that the work area must be kept much smaller during excavation of old garbage in order for odor mitigation effects to be effective. Once the refuse was rendered aerobic, the odor level dropped markedly.

Birds were not attracted to the biostabilizing material, nor were rodents observed. No fly populations were observed due to the winter season of the activity.

PROJECT PHASE II – STABILIZED PLACEMENT OF NEW REFUSE

Following the creation of the 2.15 acre (0.87 hectare) cavity resulting from volume reduction of buried refuse during Phase I, the program continued with stabilized placement of new refuse as fill material.

General Procedure

Shredded refuse [nominal 4 in. ((0.10 m) particle size] was placed in windrows, mats, pyramids, and other pile shapes. Various means to distribute air and adjust moisture were employed and evaluated. Forced air static pile regimes and mechanical manipulation re-aeration methods were developed and observed.

During the period from July 1990 through July 1991 about 20,000 tons (18,144 metric tons) of shredded refuse were placed in various configurations. Detailed monitoring of oxygen, methane, moisture, and ammonia concentrations was performed and recorded. Temperature profiles and responses to variable conditions were measured and recorded. Substrate temperatures reached as high as 185°F (85°C) during periods of active microbial respiration.

Special emphasis was placed on development of odor and vector control techniques. A synthetic cover (the Posi-Shell™ system) was developed to provide litter and vector control on the piles of biostabilizing refuse. Commercially available odor neutralizing agents were occasionally injected into the forced air stream or included in the synthetic cover formulation.

Regular topographic surveys were performed on the placement area and compared with weight records to determine airspace consumption and effective density. As a comparison, the adjacent conventional landfilling activity was also surveyed and effective refuse densities were computed. Effective density is the mass of refuse, as measured by the landfill scale, divided by the airspace consumed as measured by topographic survey.

Summary of Results

Volume Reduction

In general, the airspace consumption of municipal refuse was reduced by 40–50% through practice of stabilized placement with a bioreduction period of two (2) to six (6) months. Table 1 summarizes Phase II volume reduction findings.

Environmental Impacts

Stabilized placement has been consistently observed as superior to conventional landfilling with respect to odors, vectors, and litter. Observers have included regulatory inspectors, engineers, and public officials.

Birds are not attracted to biostabilizing material once it reaches the thermophilic stage; fresh refuse may be rendered unattractive to birds by covering with alkaline synthetic cover material such as the Posi-Shell™ cover system.

Fly eggs and larvae are deposited in the upper several inches of the refuse piles. The stucco-like synthetic cover forms a crust which retains the heat as the temperature rises; within a few days the eggs and larvae are killed by this heat and the reproduction cycle is broken. Flies have not been a problem even on top of very large mats of properly covered biostabilizing refuse. Conversely, flies are definitely a problem if the material does not receive the proper surface treatment.

CONCLUSIONS

(a) Municipal refuse can be successfully aerobically biostabilized in a landfill cell.

(b) Odor and vector impacts can be satisfactorily controlled. Active measures are required for effective control.

(c) Volume reduction can be very significant compared with conventional landfill practice.

(d) Stabilized refuse placement is more orderly and yields a more predictable final mass compared with conventional landfilling.

TABLE 1 ALBANY PROJECT PHASE II — EFFECTIVE DENSITY SUMMARY

A. Conventional Landfill Compaction

Date of Survey	Original Refuse Weight, Ton (Metric Ton)	Airspace Consumed, cy (m^3)	Effective Density, lb/cy (kg/m^3)
29 Oct. '90	3,515 (3,189)	5,400 (4,129)	1,302 (772)
17 Jan. '91	21,429 (19,440)	32,597 (29,924)	1,315 (780)
18 Jan. '91	136 (123)	251 (192)	1,082 (641)

B. Biostabilized Refuse Placement

Date of Survey	Average Stabilization Time, Days	Original Refuse Weight, Ton (Metric Ton)	Airspace Consumed, cy (m^3)	Effective Density, lb/cy (kg/m^3)
29 Oct. '90	37	1,933 (1,754)	1,995 (1,525)	1,937 (1,149)
18 Jan. '91	80	921 (836)	860 (658)	2,142 (1,271)
09 Aug. '91	60	2,122 (1,925)	2,100 (1,606)	2,021 (1,199)